

L3(5.3) - Transformations & Graphing from Vertex Form

vertex form:

$$y = \pm a(x - h)^2 + k$$

+, parabola opens up
-, parabola opens down

- if $a > 1$, vertical stretch
- if $0 < a < 1$, vertical compression

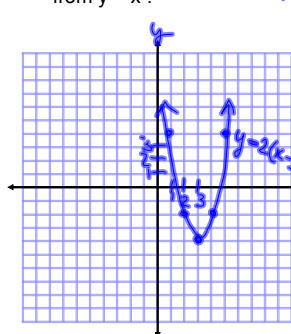
• h is the x -coordinate of the vertex
• will result in a horizontal shift (left or right).

• k is the y -coordinate of the vertex
• will result in a vertical shift (up or down)

To graph, choose a strategy:

1. Table of Values
 - starting method for any graph
 - try to choose x -values around axis of symmetry
 - calculate y -values and plot points
2. Transformations
 - determine transformations in correct order
 - apply transformations to key points from $y = x^2$
3. Vertex & Step Pattern
 - determine location of vertex
 - determine step pattern compared to $y = x^2$
 - note direction of opening (vertical reflection?)
 - build parabola starting at vertex

Ex.1 Graph $y = 2(x - 3)^2 - 4$ by transforming points from $y = x^2$.



Step pattern

+2, 6, 10

Vertex (3, -4)

 $y = x^2$

x	y
-2	4
-1	1
0	0
1	1
2	4

Parent

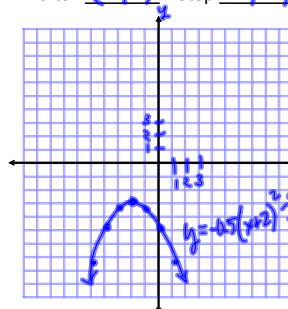
- 1) V. Stretch by a factor of 2 ----- effects (y)
- 2) H. Shift right by 3 ----- effects (x)
- 3) V. Shift down by 4 ----- effects (y)

$(-2, 4) \xrightarrow{y \times 2} (-2, 8) \xrightarrow{x + 3} (1, 8) \xrightarrow{y - 4} (1, 4)$
 $(-1, 1) \rightarrow (-1, 2) \rightarrow (2, 2) \rightarrow (2, -2)$
 $(0, 0) \rightarrow (0, 0) \rightarrow (3, 0) \rightarrow (3, -4)$
 $(1, 1) \rightarrow (1, 2) \rightarrow (4, 2) \rightarrow (4, -2)$
 $(2, 4) \rightarrow (2, 8) \rightarrow (5, 8) \rightarrow (5, 4)$

Ex.2 Graph $y = -0.5(x + 2)^2 - 3$ using the vertex and step pattern.

State the vertex and the step pattern, then graph.

$$(a) y = -(x - 4)^2 + 5$$

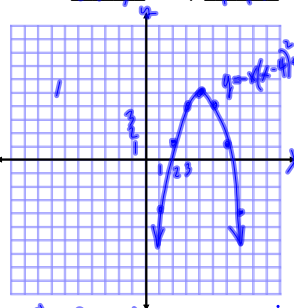
Vertex $(-2, -3)$ Step $-0.5, -1.5, -2.5$ Vertex $(4, 5)$ Step $-1, -3, -5$ 

① Reflection in the x axis

② Vertical compression by a factor of 0.5

③ horizontal shift left by 2 units

④ Vertical shift down by 3



① Reflection in the x axis

② horizontal shift right by 4

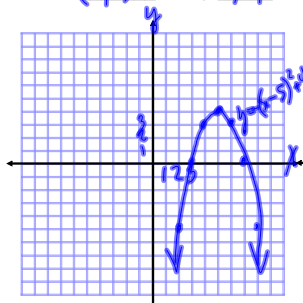
③ Vertical shift up by 5 units

State the vertex and the step pattern, then graph.

(a) $y = -(x - 5)^2 + 4$

Vertex $(5, 4)$

Step $-1, -3, -5$

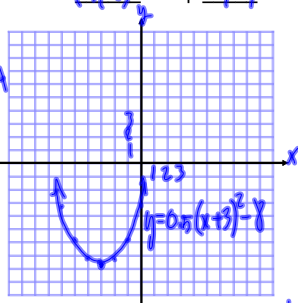


- ① reflection in the x axis
- ② horizontal shift right by 5 units
- ③ vertical shift up by 4 units

(b) $y = 0.5(x + 3)^2 - 8$

Vertex $(-3, -8)$

Step $0.5, 1.5, 2.5$



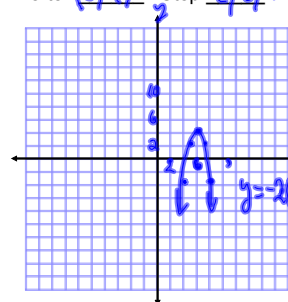
- ① Vertical compress by a factor of 0.5
- ② horizontal shift left by 3 units
- ③ Vertical shift down by 8 units

State the vertex and the step pattern, then graph.

(c) $y = -2(x - 6)^2 + 4$

Vertex $(6, 4)$

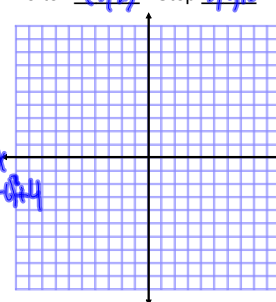
Step $-2, -6, -10$



(d) $y = 3(x + 5)^2 - 2$

Vertex $(-5, -2)$

Step $3, 9, 15$



Assigned Work: p.269 #1 - 3 (basics),

4odd, 5odd, 6, 7odd, 11, 13, 14, 15, *10